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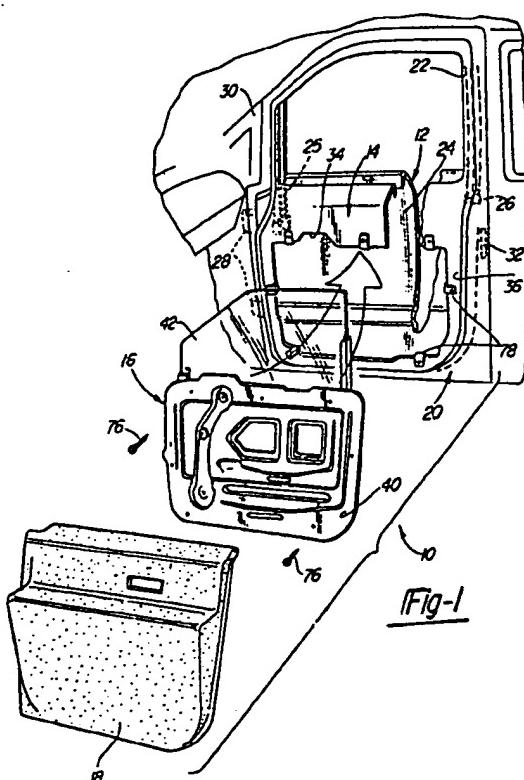
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(54) Vehicle door with separable door hardware module.

(57) A main door unit including an inner/outer panel subassembly (12, 14) is mounted to the vehicle (30) in a generally conventional manner so that it can be painted along with other parts of the vehicle (30) during on-line assembly. However, the inner panel (14) includes a generally centrally located enlarged opening (34) therein and is devoid of any substantial door hardware during painting. The door hardware including the window glass (42), lower front and rear glass tracks (44, 46) and the regulator mechanisms (50, 52, 54, 56) for the window (42) are mounted to a plate (40) to form an integral door hardware module (16). After painting, the module (16) is mounted to the inner panel (14) with the window glass tracks (44, 46) mating with upper glass tracks (25, 26) in the inner/outer panel subassembly (12, 14). The plate (40) covers the opening (34) in the inner panel (14) and a trim pad (18) can be used to cover the plate (40) and peripheral portions of the exposed interior inner panel (14) for cosmetic purposes.



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## VEHICLE DOOR WITH SEPARABLE DOOR HARDWARE MODULE

This invention relates to vehicles and, more particularly, to doors for land vehicles.

Although a variety of door constructions have been proposed in the technical and patent literature, conventional practice is for vehicular doors to include an inner and outer panel fixed together about their edges thereby forming a hollow shell in the interior lower portions thereof. The inner panel includes relatively small access openings to permit hardware such as window regulator mechanisms and the like to be inserted therethrough and attached during the typical on-line assembly process. Of course, this tends to be an awkward operation for the worker and can lead to improper installation.

U.S. - A - 4,308,381 discloses a door construction for solving this general problem. However, some of the parts in the inner panel subassembly are exposed and accordingly must be painted to match the rest of the door. It is envisioned that the inner panel subassembly is produced off-line and then attached as one of the final steps during on-line assembly. Consequently, it appears that this would require that the on-line and off-line assembled parts of the door be separately painted. Of course, it is not always possible to provide a perfect color match under these circumstances.

It is the object of the invention that all of the exposed portions of the inner and outer panel that need to be painted can be painted during conventional on-line assembly of the vehicle.

The means for obtaining this object are described in the claims. Particularly, the inner door includes a generally centrally located enlarged opening but most of the door hardware is not attached to the panel. Instead, the door hardware is attached off-line to a plate forming part of a door hardware module that contains such things as the window glass, lower front and rear glass tracks, and window regulator mechanisms for controlling the vertical movement of the window. As one of the final assembly steps, the module is attached to the inner panel after the inner/outer panels have been painted. An interior trim panel may be added to cover the plate and peripheral portions of the lower/inner panel to provide a cosmetic appearance for the completed door.

The various advantages of the present invention will become apparent to those skilled in the art after reading the following specification and by reference to the drawings in which:

FIGURE 1 is a partial exploded perspective view of a vehicle including a door made in accordance with the teachings of the present invention as viewed from the interior of the vehicle;

FIGURE 2 is an exploded perspective view primarily of the door hardware module as viewed from a side opposite to that of FIGURE 1;

FIGURE 3 is a partial perspective view illustrating the detachable coupling between upper and lower glass track sections; and

FIGURE 4 is a simplified cross-sectional view of the completed door.

With reference to the drawings, vehicle door 10 includes four main parts: an outer panel 12, an inner panel 14, a door hardware module 16 and an interior trim pad 18. The outer panel 12 and inner panel 14 are secured together to form a main door unit 20 which, to a large extent, is of conventional design. In this example, the outer panel 12 and inner panel 14 are metal stampings which are hemmed together to provide a window frame portion 22 above the belt line and defining a hollow interior cavity 24 below the belt line. The window frame portion 22 encompasses upper front 25 and rear glass track sections for receiving upper edges of the window when it is in its raised position. As conventional, window frame 22 also includes suitable weather stripping and the like. One side of the main door unit 20 also includes suitable hinge devices 28 for swingingly mounting main door unit 20 onto the body of the vehicle 30 in a conventional manner. Main door unit 20 may also include suitable locking mechanisms designated by the numeral 32.

Thus, the main door unit 20 is designed to be mounted to the vehicle body as is conventional practice during on-line assembly. This enables the main door unit 20 to be painted along with vehicle body to thereby ensure good color matching. However, when the vehicle is painted, the module 16 is not yet attached. On the contrary, module 16 can be completely assembled off-line, for example, by a vendor to the vehicle manufacturer. None of the parts on module 16 need to be painted and, consequently, color matching is no problem. In addition, the module 16 is preassembled into one substantially integral unit ready for easy attachment as will appear. Consequently, the awkward step-by-step attachment of door hardware through small access openings discussed above is substantially eliminated. The vehicle manufacturer also benefits from lower inventory requirements and an improvement in overall product quality.

A study of the drawings will reveal that the inner panel 14 includes a generally centrally located enlarged opening 34 in its inner face 36. Opening 34 is dimensioned so that it will permit the window and associated door hardware on module 16 to be inserted therethrough as will be discussed

later herein.

Focusing attention on module 16, it is provided with a mounting plate 40 whose peripheral dimensions are larger than the door opening 34. Plate 40 is preferably made of preprimed galvanized steel or other rigid material that is rust resistant. Onto plate 40 is attached window glass 42, lower front 44 and rear 46 window glass tracks and suitable window regulating means for controlling vertical movement of window 42. The window regulator means illustrated in the drawings include electric motor 50 driving a sector gear 52 coupled to an arm 54 through a link 56. The door regulator mechanisms are preferably attached to a doubler reinforcement member 58 suitably attached to plate 40 to provide it with additional rigidity. Window regulator arm 54 is provided with a roller 55 at its distal end which rides in a glass attaching "U-channel" 60. Channel 60 is connected to the window glass 42 by way of fasteners 62. It should be understood that other automatic window regulating devices can be used, as well as manual constructions.

Completing the description of module 16, wiring harnesses 64 and 66 are illustrated for controlling the door motor 50 and auxiliary devices such as automatic door locks and the like, respectively. Preferably, a vapor and sound barrier sheet 68 is adhered to the inner face of plate 40 by way of suitable adhesive sealer 70.

Thus, it can be appreciated the module 16 is in the form of a one-piece unit that can be assembled and tested off-line and then shipped to the vehicle manufacturer ready to be assembled to the main door unit 20.

Module 16 is easily assembled by inserting window 42 through opening 34 and sliding the edges of window 42 into the upper glass tracks 25, 26 already contained within the main door unit 20. As can be seen most clearly in Figures 2 and 3, lower ends of the upper glass tracks 25, 26 and upper ends of the lower glass tracks 44, 46 are interlockingly fitted together to thereby bring the two sets of track sections into permanent alignment. Various detachable coupling constructions can be used but, in this embodiment, this is provided by an enlarged head 70 on the upper sections onto which the lower sections slideably fit. A spring clip 72 on the lower track section snaps into a detent 74 in the head when the lower section has been inserted to the proper extent.

Once the window has been inserted, the plate 40 is brought flush against the inner face 36 of the inner panel 14 and attached thereto via fasteners 76 and mounting brackets 78. The peripheral dimension of plate 40 is larger than that of the opening 34 so that the plate 40 covers the opening.

To complete the door assembly, it is some-

times necessary to connect the various wiring harnesses to certain internal components such as door locks and the like. This can be easily accomplished by pulling back the sheet 68, manually making the necessary connections, and then resecuring the sheet 68. Therefore, the plate 40 and the remaining exposed peripheral portions of the lower/inner panel 14 are covered by a conventional trim pad 18.

The various advantages of the present invention will become apparent to those skilled in the art after having the benefit of a study of the specification, drawings and following claims.

## 15 Claims

1. A vehicle door comprising:  
an outer panel (12);  
an inner panel (14) having a generally centrally located enlarged opening (34) therein, the inner (12) and outer panel (14) being secured together to form a main door unit (20) defining at least a lower hollow cavity (24);  
means (28) for mounting the main door unit (20) to a body of the vehicle (30) whereby the main door unit (20) can be painted simultaneously with the body of the vehicle;
2. The door of Claim 1 wherein said lower glass track sections (44, 46) on the module (16) are detachably coupled to upper glass track sections (25, 26) within a window frame portion (22) of the main door unit (20) thereby bringing the lower (44, 46) and the upper glass track portions (25, 26) into alignment.
3. The door of Claim 2 wherein said plate (40) covers the opening (34) in the inner panel (14) and is attached thereto about its periphery by a plurality of fasteners (76).
4. The door of Claim 3 which further comprises:  
a trim pad (18) covering said plate (40) and exposed peripheral portions of an inner face of the inner panel (14).
5. The door of Claim 4 wherein said door hardware further includes at least one wiring harness (64, 66), and wherein said plate (40) includes at least one access opening therein permitting worker access to the harness (64, 66).

6. The door of at least one of the Claims 1 to 5 wherein said plate (40) is preprimed galvanized steel and includes a doubler reinforcement member (58) attached thereto onto which at least part of said window regulator means (50, 52, 54, 56) is attached.

7. A vehicle door particularly according to at least one of the preceding claims comprising:

an outer panel (12) having a lower skin and an upper window frame portion (22);

an inner panel (14) having a generally corresponding upper window frame portion (22) attached to the outer panel (12), lower portions of the inner panel (14) and the outer skin defining a hollow cavity (24), an inner face (36) of the inner panel (14) including a generally centrally located enlarged opening (34) therein of a given longitudinal dimension;

upper glass track sections (25, 26) in the window frame (22);

a door hardware module (16) having a plate (40) with a peripheral dimension larger than the opening (34) in the inner panel (14), front and rear lower glass track sections (44, 46) vertically extending on opposite edges of an outer face of said plate (40), a window glass (42) slideably mounted in the lower glass tracks (44, 46), and window regulator means (50, 52, 54, 56) mounted to the plate (40) for controlling vertical movement of the window (42);

fastening means (76) for connecting the plate (40) to the inner panel (14) so that the plate (40) covers the opening (34) in the inner panel (14), with the upper (25, 26) and lower glass track sections (44, 46), being interfitted at their adjacent edges thereby bringing them into alignment; and

a trim pad (18) covering the plate (40) and peripheral portions of the inner face (36) of the inner panel (14).

8. The door of Claim 7 which further comprises:

a doubler reinforcement member (58) to which at least a part of said window regulator means (50, 52, 54, 56) is attached.

9. The door of Claim 7 or 8 wherein upper edges of the lower glass track sections (44, 46) include an enlarged head (70) with a detent (74) on a side thereof, and wherein lower edges of the upper glass track sections (25, 26) slidingly fit within the head (70) and include a spring clip (72) for engaging said detent (74).

10. In a method of making a vehicle, the improvement comprising:

attaching a main door unit (20) to a body of the vehicle (30), the door including an outer (12) and inner panel (14) with a generally centrally located opening (34) therein providing access to an otherwise substantially empty cavity (24);

5 painting the main door unit (20) substantially simultaneously with the remaining portions of the vehicle body (30);

10 providing a door hardware module (16) having a plate (40) to which a window glass (42) and associated hardware including glass track sections (44, 46) and a window regulator (50, 52, 54, 56) therefore are attached; and

15 assembling the module (16) to the door so that the window (42) and associated hardware extends through the cavity (24) and the plate (40) covers the opening (34).

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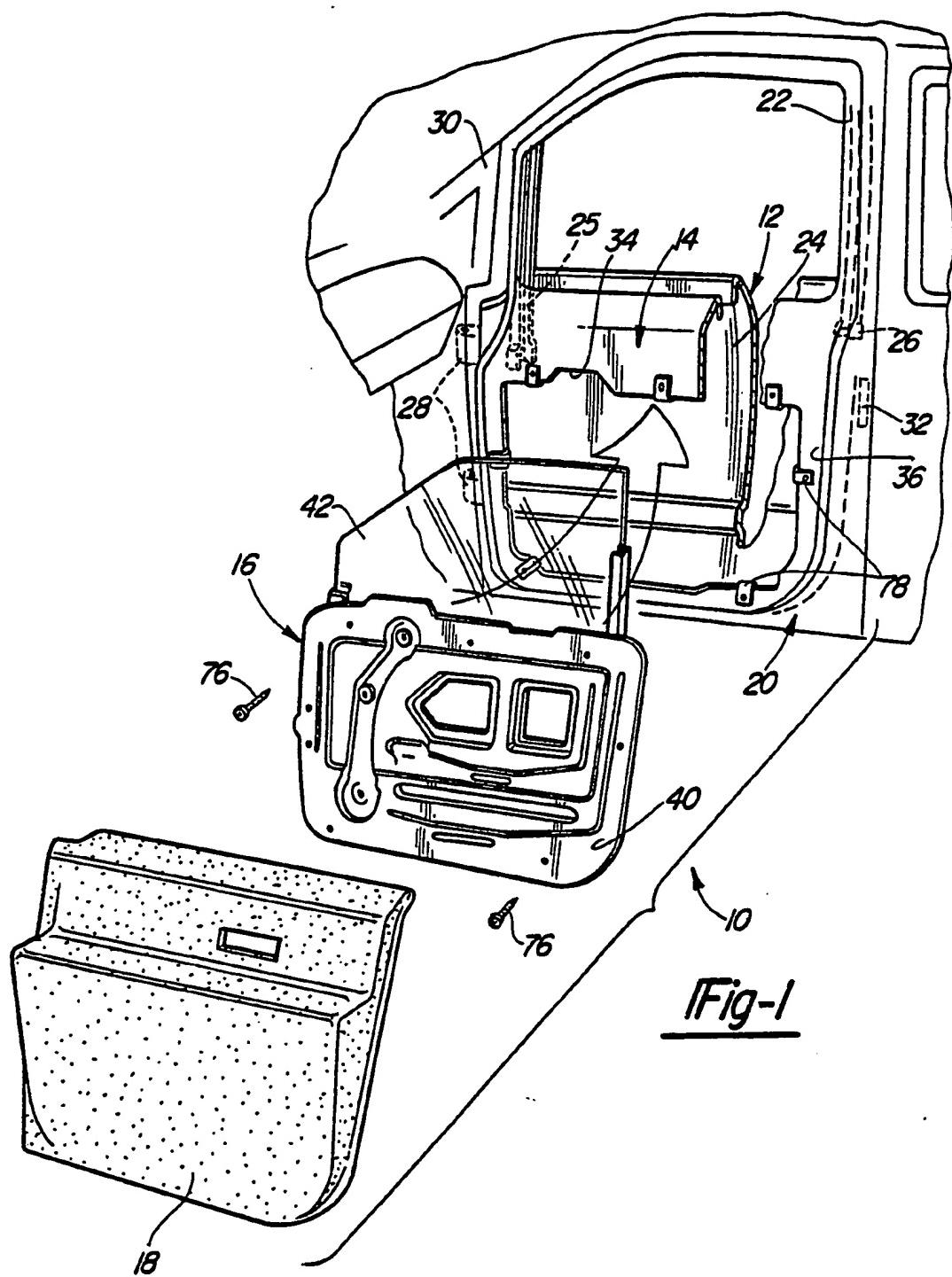
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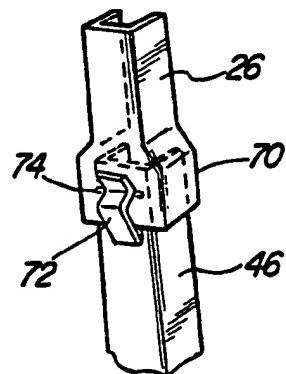
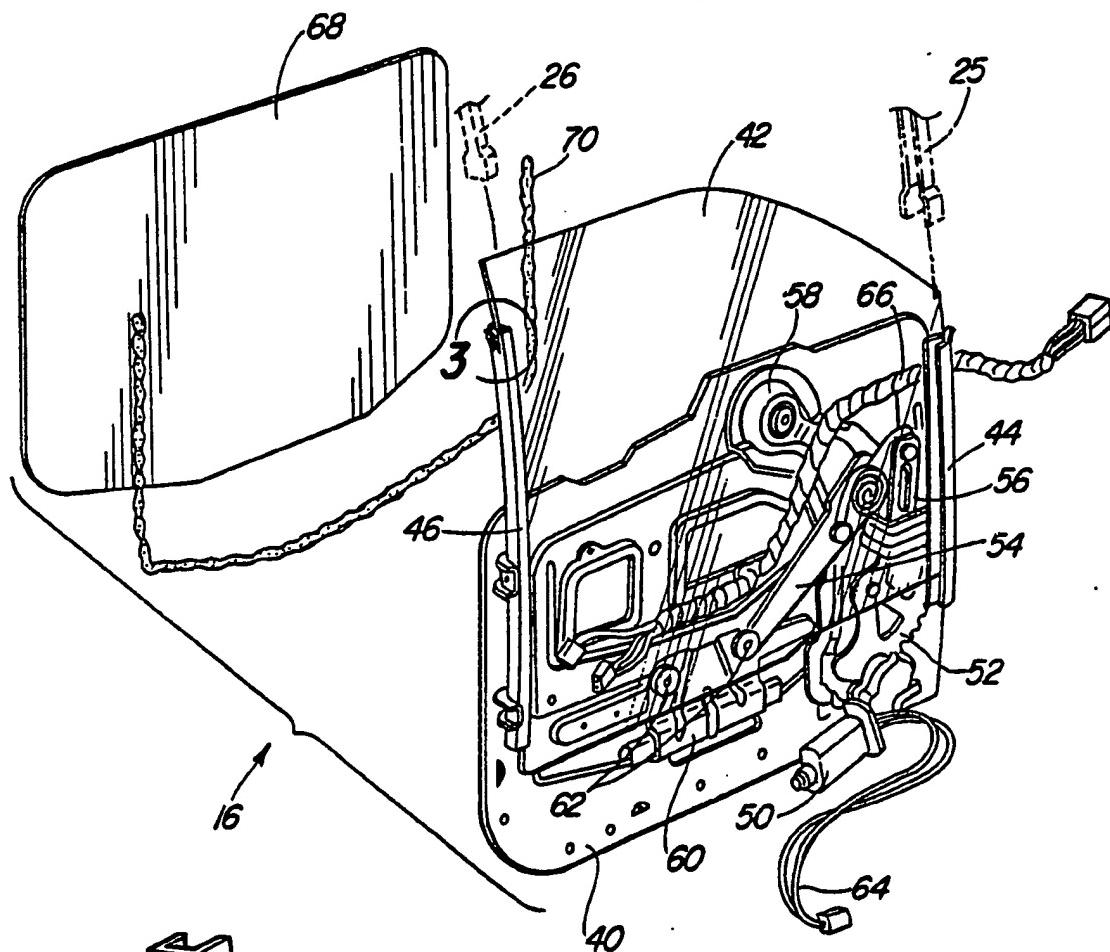
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Fig-2Fig-3

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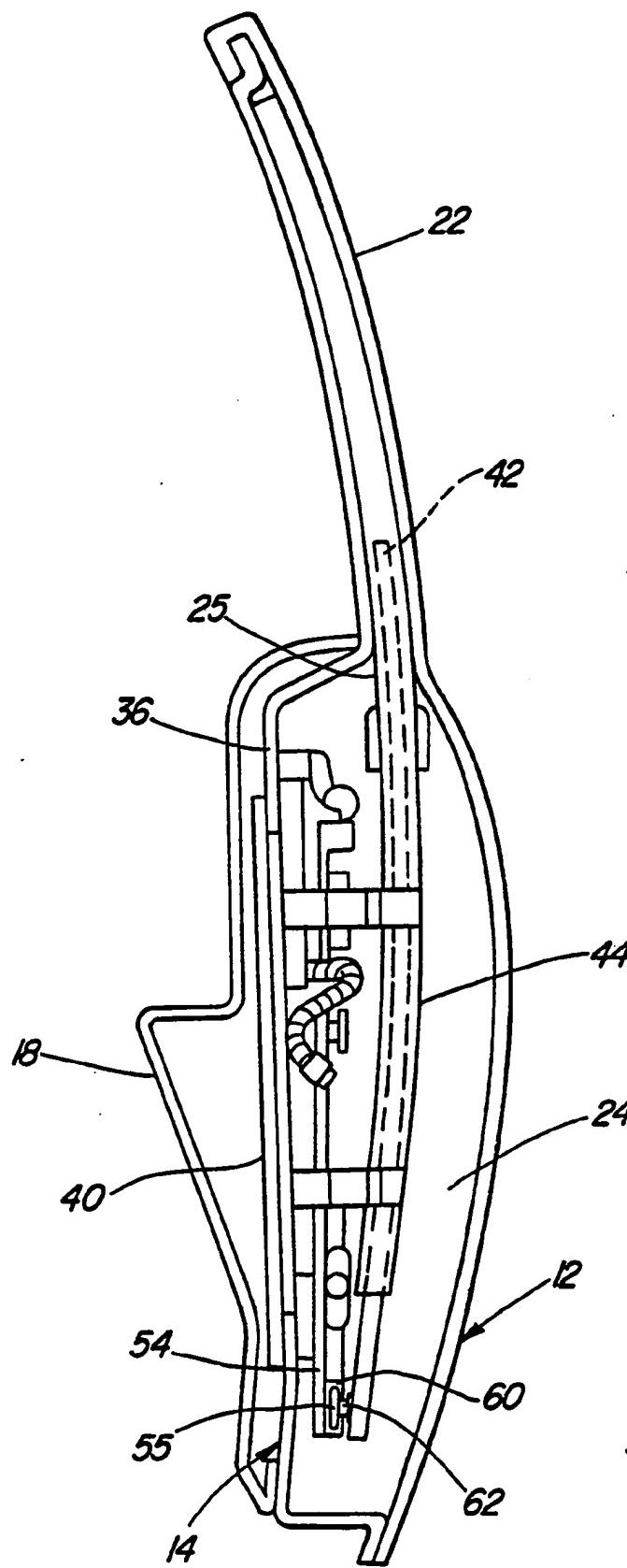


Fig-4